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GB 2225634 A

GB 2210907 A

EP 0604875 A

WO 95/22762 A

US 5130559 A

US 4953265 A

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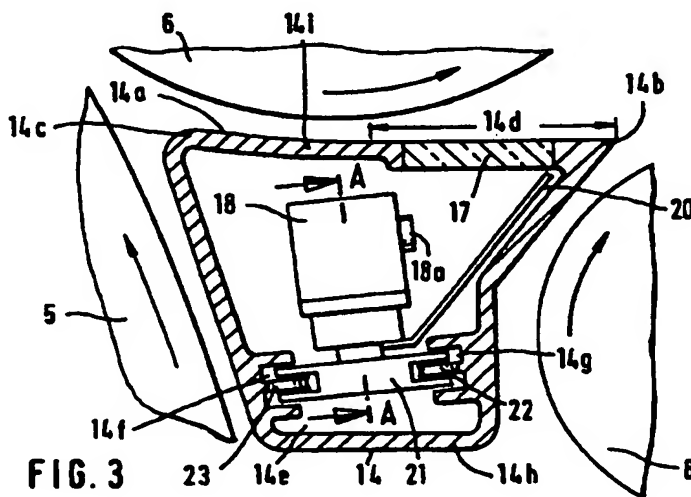
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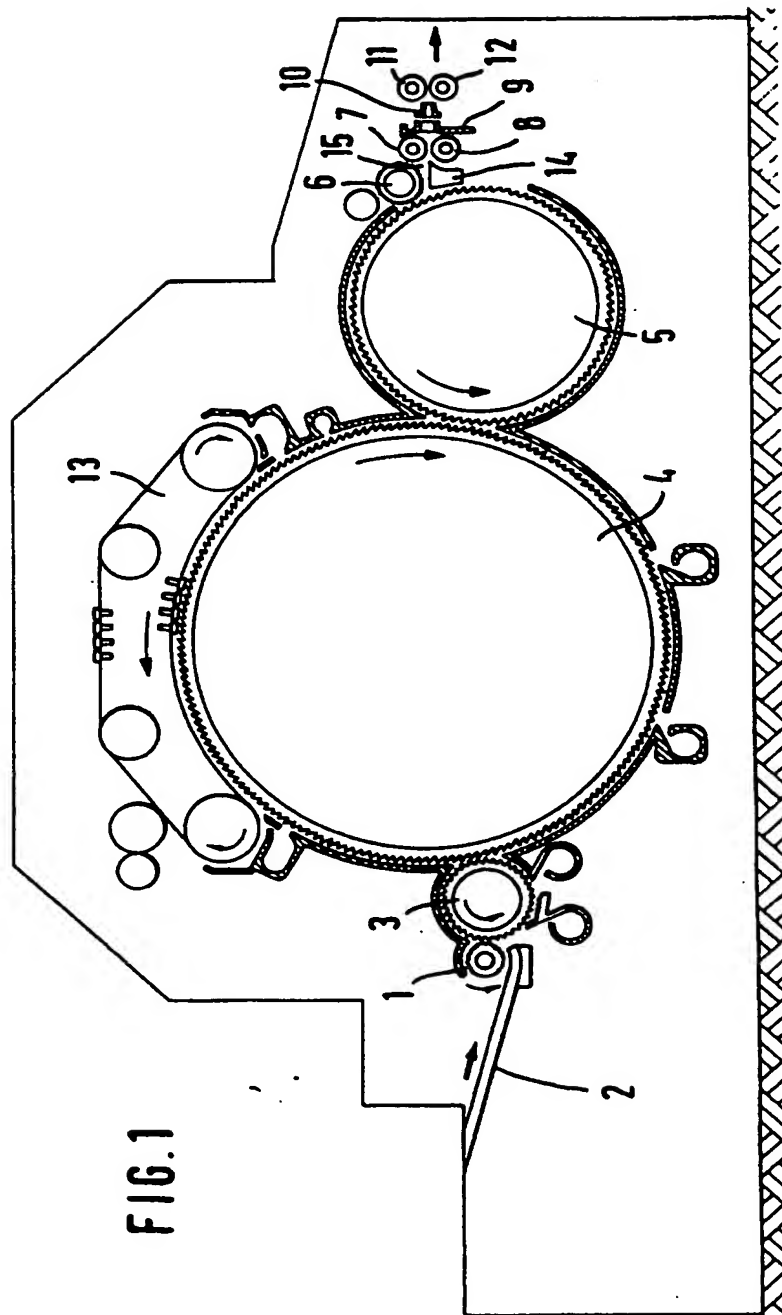
## (54) Carding Machine: Detecting Unwanted Particles

(57) Apparatus on a carding machine for detecting unwanted particles, e.g. waste bits, neps, seed husk and burls, fibre web, comprises a camera 18 and lighting means (19, not shown) traversed on carriage 21 across and beneath a web running from stripper roller 6 to nip rollers (7, not shown) and 8. The camera records images via window 17 and mirror 20, which are transmitted for machine control and display. The camera may be located between the nip rollers and a sliver former, where the camera and lighting means may alternatively be stationary and operate via optic waveguides.



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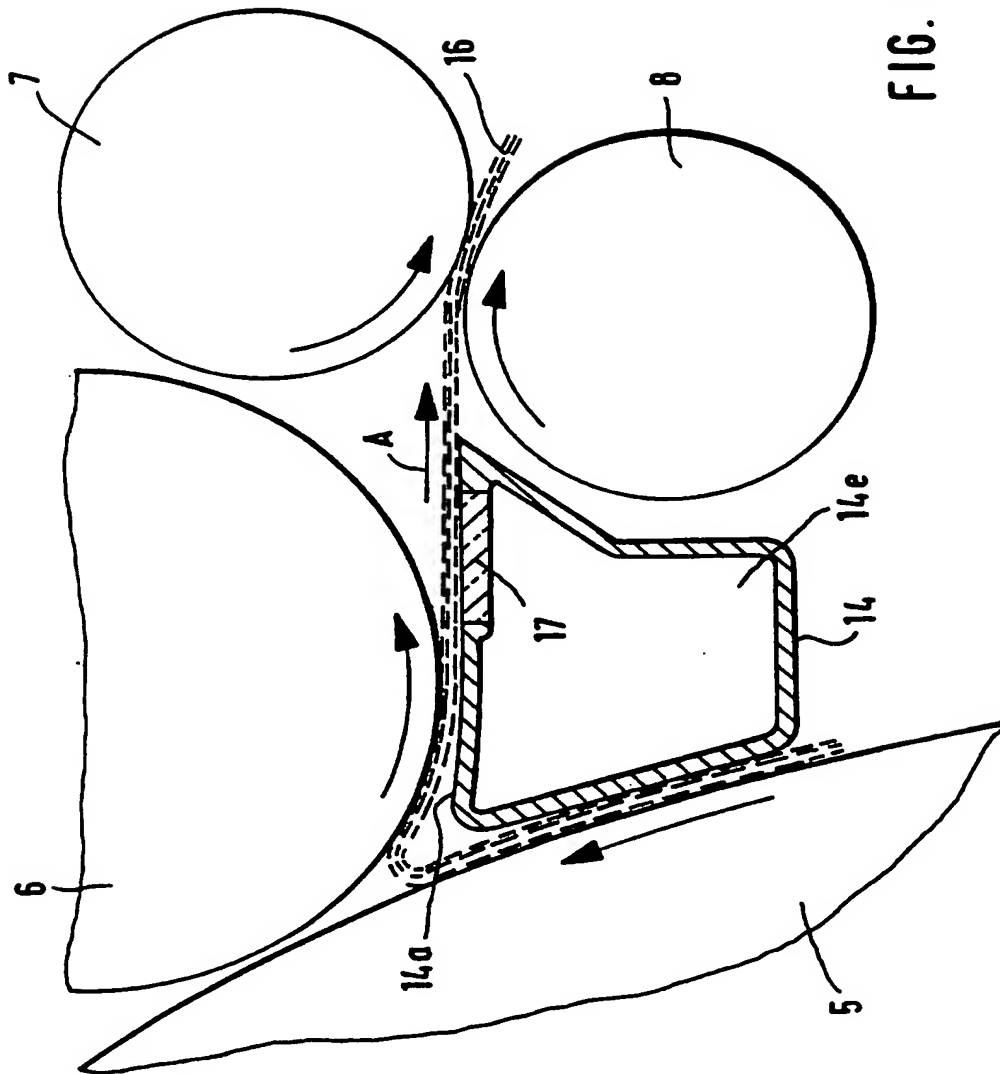
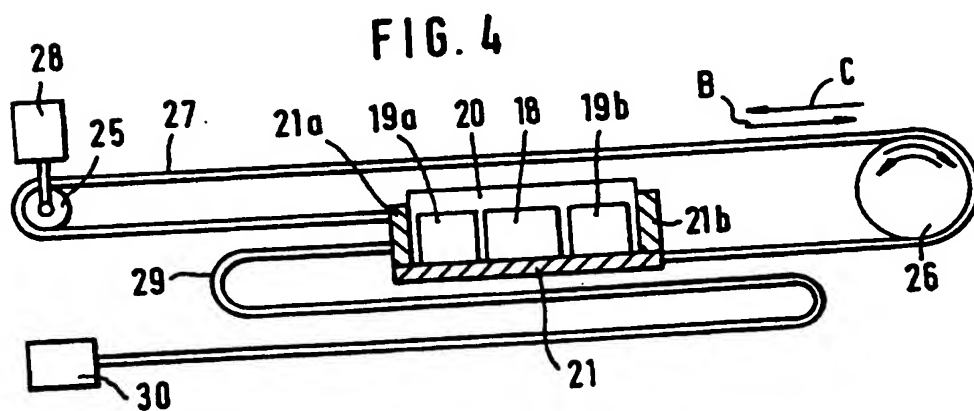
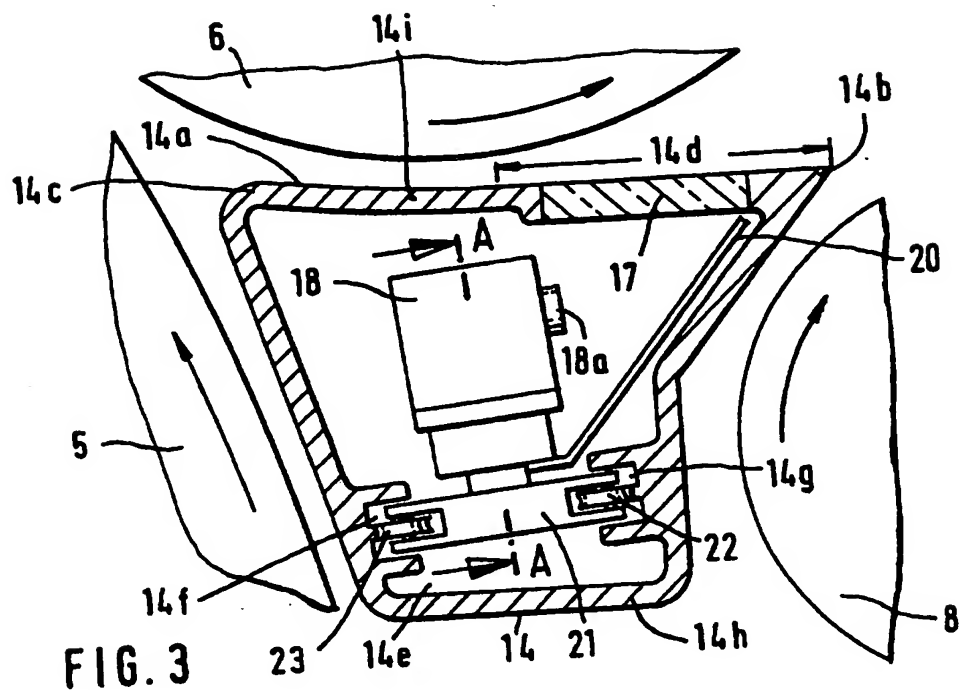


FIG. 2



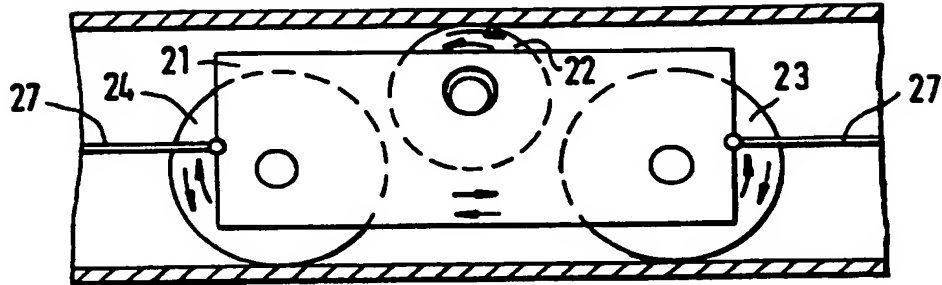


FIG. 5

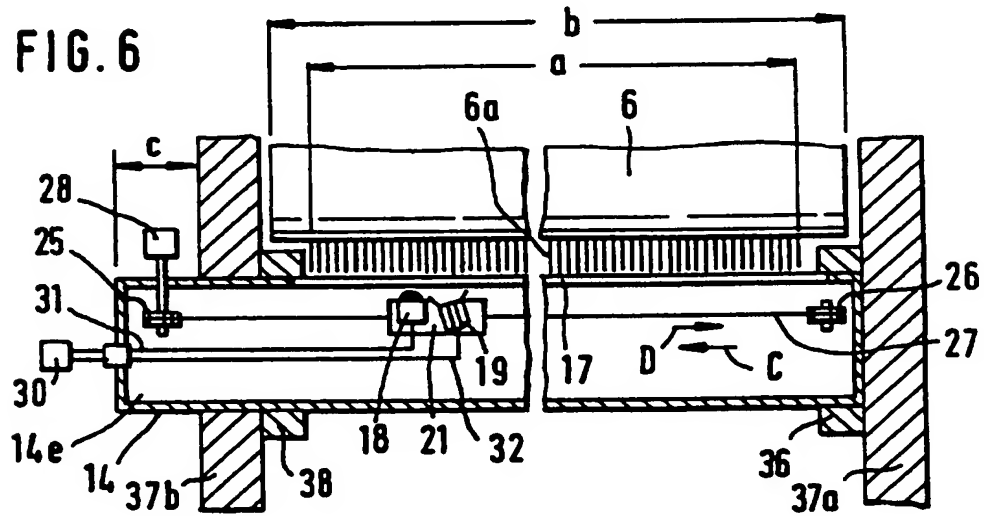


FIG. 6

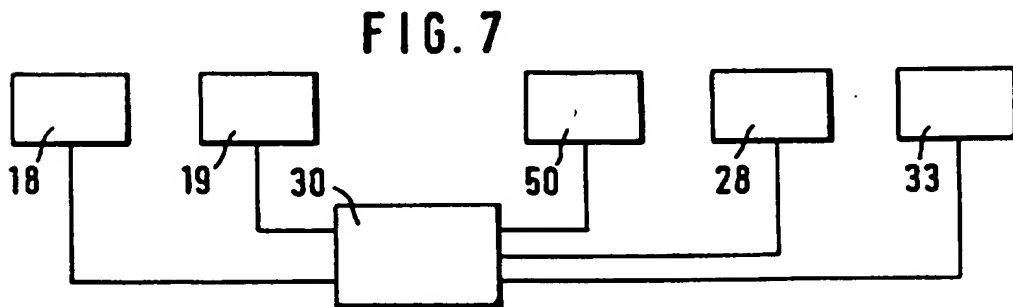
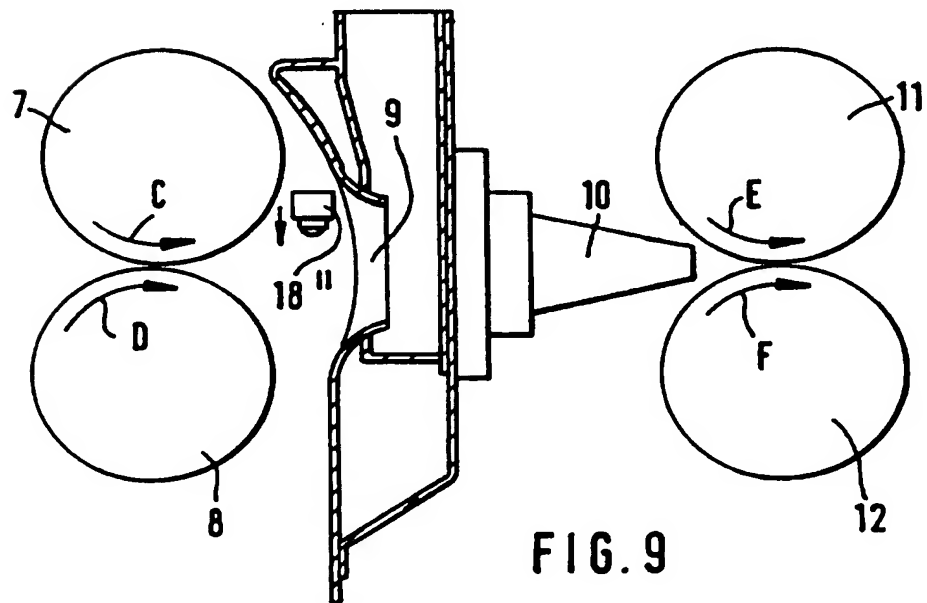
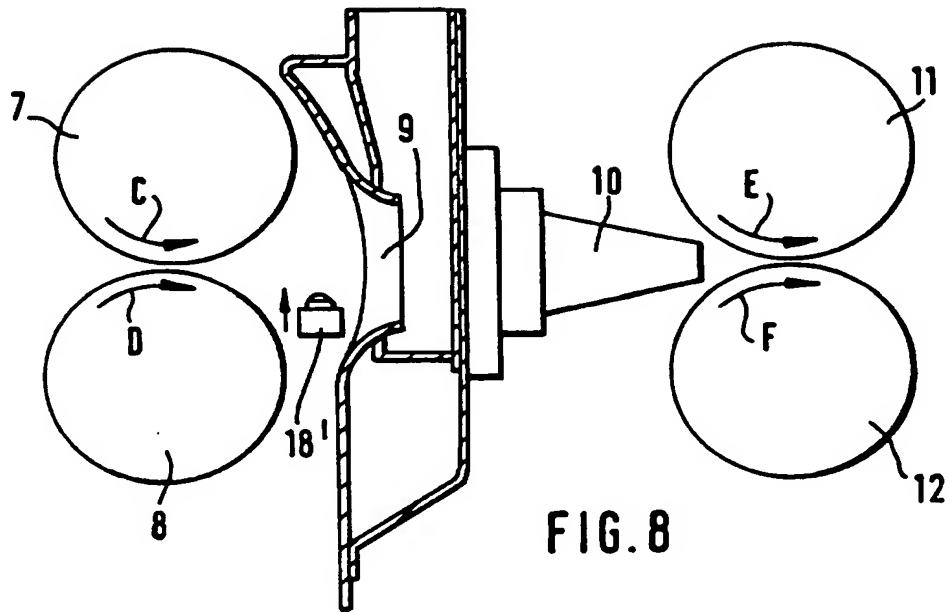
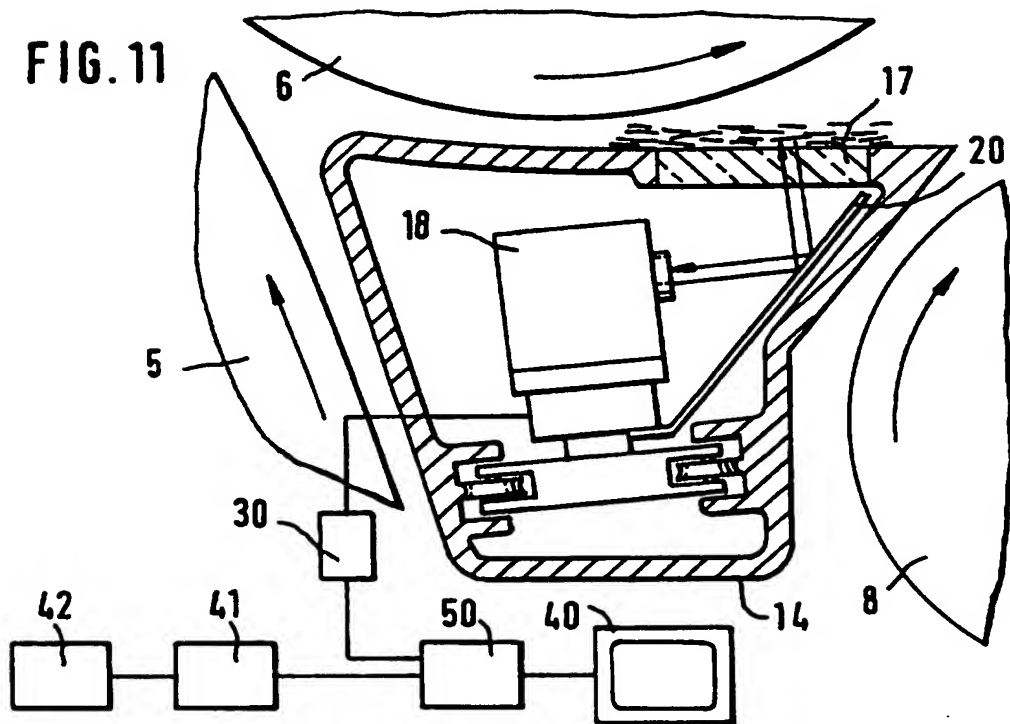
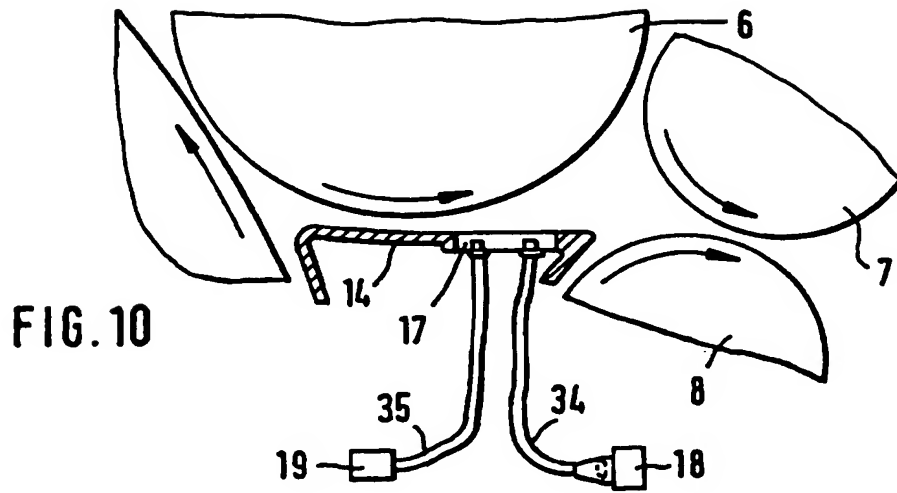


FIG. 7





The invention relates to an apparatus on a carding machine for detecting unwanted particles, in particular, but not exclusively, waste bits, neps, pieces of husk, burls and the like in the textile fibre material, for  
5 example, cotton, synthetic fibres and similar materials.

In a known apparatus a measuring section is provided between the stripper roller and nip rollers for the fibre material, wherein a camera, for example, a diode line camera, is arranged at the measuring section to  
10 record the degree of contamination, and the apparatus includes an illuminating device and an electronic evaluator (image-processing unit).

In a known apparatus, a camera is provided for detecting the unwanted particles.

15 It is an object of the invention to improve such an apparatus for the detection of unwanted particles and to enable the evaluation of the measurement results to be improved.

According to the invention there is provided a  
20 carding machine including a camera for detecting unwanted matter in fibre material passing through the machine, wherein the camera is arranged to monitor a card web as it is transferred between one fibre transport or processing means and the next fibre transport or  
25 processing means.

According to the invention there is also provided



an apparatus on a carding machine for detecting unwanted particles, in particular waste bits, neps, seed husks, burls and the like in the textile fibre material, for example, cotton, synthetic fibres and similar materials, 5 in which a measuring section is provided between the stripper roller and nip rollers for the fibre material, wherein a camera, for example, a diode cell camera, is arranged at the measuring section to record the degree of contamination, and the apparatus includes an illuminating 10 device and an electronic evaluator (image-processing unit), characterised in that the camera is associated with the card web in transition between the stripper roller and nip rollers.

Because the camera is associated with the card web 15 in free transition, detection (image detection) of the particles is achieved without the clothing of the evenner roller and the conveyor surfaces of the squeeze rollers exerting any influence. In this manner, evaluation of the measurement results is concentrated on the particles 20 which are present in the card web and have been detected, so that overall a considerably better recognition of the unwanted particles in the card web is achieved.

Preferably the camera is arranged at a distance from the clothing of the stripper roller and from the outer 25 surfaces of the nip rollers. The camera is preferably arranged on the side of the card web remote from the stripper roller, and preferably on the side of the card web remote from the one nip roller. Preferably the

camera is arranged beneath the stripper roller.

Beneath the stripper roller there is preferably a fixed-position supporting and guiding member for the fibre material, the upper surface of which faces towards the stripper roller and the one end region of which is arranged in the region between the stripper roller and the nip rollers. The top wall of the supporting and guiding member preferably comprises a transparent region, for example, of glass.

The supporting and guiding member is preferably in the form of a housing. The camera, which may for example be a diode line camera, is preferably arranged in the interior of the housing. The housing is preferably an extruded section, for example made of aluminium. The housing is preferably closed. The glass surface is preferably in the form of a window. The supporting and guiding member is preferably an extruded section, the interior having two guide spaces for the carriage.

Advantageously there are guide elements, for example rails, recesses or the like, in the interior of the housing. The housing preferably extends at least across the width of the carding machine (working width). A travelling slide, carriage or the like is preferably guided by the guide elements. The camera and the illuminating device, for example luminous diodes, are preferably arranged on or at the travelling slide, carriage or the like. A conveying or transport device for the displacement is preferably associated with the

travelling slide, carriage or the like. The conveying or transport arrangement preferably includes two pulleys and a cable or a belt having a driver member for the travelling slide, carriage or the like. The drive  
5 device, for example a drive motor, is preferably associated with one pulley. The drive device is preferably connected to an electronic control device. Limit switches and/or sensors for the movement to and fro of the travelling slide, carriage or the like are preferably  
10 associated with the control device.

The camera and/or the illuminating device is/are connected by means of at least one flexible cable, for example a resilient coiled cable, flat conductor cable or the like to a connection device, for example to a  
15 terminal device, power supply or the like.

The cable is preferably passed through openings in the wall of the housing. The lead-through opening preferably has a seal against dust. The flexible cable may be present in the interior of the housing. At least  
20 one plug-in connection for the cable may be associated with the opening in the wall of the housing.

The cable may include a lead for the camera and a lead for the illuminating device. At least one sealed end face of the housing is preferably removable.

25 The supporting and guide member or the housing can preferably be slid in and out beneath the stripper roller. The housing is preferably displaced in its longitudinal direction. In the region in which the web

becomes detached, the machine frame preferably has lateral openings for securing the housing. The housing can preferably be inserted through the openings.

The cable connections to the camera preferably have  
5 at least one multi-conductor plug.

The drive device for the carriage is preferably arranged outside the housing.

The multi-conductor plug(s) is/are preferably arranged on an end wall of the housing.

10 Clean compressed air is preferably admitted to the interior of the housing. In the wall of the housing there are preferably cooling openings for the passage of air.

At least one tilted mirror is preferably arranged  
15 between the camera and the clothing of the roller. At least one tilted mirror (which may be the same mirror) is preferably arranged between the illuminating device and the clothing.

The light beam coming from the illuminating device  
20 or from the tilted mirror in the direction of the clothing preferably lights up the surface of the glass window and is preferably perpendicular thereto.

There are preferably connected to the electronic control and regulating device at least the camera, the  
25 illuminating device, an image evaluating device and the drive device for the carriage.

Preferably there is a flexible flat conductor cable for the connecting lead to the camera and for the

connecting lead to the illuminating device.

The tilted mirror is preferably fastened to or on the slide , carriage or the like.

5 Preferably the camera records the card web sliding flat over the glass window.

The camera and/or the illuminating device may be fixed in position, and optical waveguides, for example glass fibre cables, may be connected to the camera and/or to the illuminating device.

10 The camera may be arranged to make use of light reflected by the web and/or light transmitted through the web. The camera may record the card web with incident light.

The control and regulating device, which may be a  
15 computer, and/or the image evaluator are preferably connected to an adjusting device for regulating the degree of cleanliness of the fibre material. The image evaluator may have a control element and an adjusting element arranged downstream thereof. The adjusting  
20 element may be capable of changing the number of neps, waste particles and/or seed husk particles in the card web. The camera may be capable of recording the number of neps in the free card web detached from the roller. The camera may be capable of recording the number of  
25 neps, waste particles and/or seed husk particles in the free card web. The adjusting element may be capable of changing automatically the number of neps in the card web in response to the number of neps detected in the

detached free card web. The adjusting element may be capable of adjusting the distance between the clothing of the card top bars of the card top and the clothing of the cylinder. The adjusting element may be capable of  
5 adjusting the speed of the cylinder.

Instead or in addition to providing a camera for monitoring the card web as it is transferred between the stripper roller and a pair of nip rollers, it is possible to provide a camera arranged to monitor a card web as it  
10 is transferred from a pair of nip rollers to a sliver-forming device. Thus the present invention further provides an apparatus on a carding machine for detecting unwanted particles, in particular waste bits, neps, seed bits, burls and the like in the textile fibre material,  
15 for example, cotton, synthetic fibres and similar materials, in which a measuring section is provided between the stripper roller and nip rollers for the fibre material, wherein a camera, for example, a diode cell camera, is arranged at the measuring section to record  
20 the degree of contamination, and the apparatus includes an illuminating device and an electronic evaluator (image-processing unit), characterised in that the camera is arranged between the nip rollers and the sliver-forming device.

25 In use, apparatus of the invention is fitted as part of a spinning preparation machine, in particular a carding machine. The apparatus may, however, be supplied separately from the machine; for example, a camera,

illuminating device and evaluator may be supplied,  
perhaps also with a housing in which the camera and  
illuminating device are mounted. Thus the invention  
further provides a camera apparatus for a spinning  
5 preparation machine as defined above.

According to another aspect of the invention, there  
is provided a method of viewing a card web travelling  
through a carding machine, the machine being in any of  
the forms defined above.

10 By way of example certain illustrative embodiments  
of the invention will now be described with reference to  
the accompanying drawings, of which:

- Fig. 1 is a schematic side view of a carding  
machine including a camera housing in the  
15 form of a card web supporting and guiding  
member;
- Fig. 2 shows the co-ordination of the supporting  
and guiding member shown in Fig. 1 with a  
stripper roller and a pair of nip rollers  
20 of the carding machine;
- Fig. 3 shows a cross-section of the camera housing  
viewed from the side of the carding machine;
- Fig. 4 shows a cable drive for a carriage in the  
camera housing;
- 25 Fig. 5 is a plan view of the carriage showing wheel  
guides for the carriage;
- Fig. 6 is a sectional end view of a further form of

- camera arrangement very similar to the arrangement of Figs. 3 to 5;
- Fig. 7 is a block diagram of an electronic control and regulating arrangement;
- 5 Fig. 8 is a sectional side view of a modified form of part of the carding machine shown in Fig. 1;
- Fig. 9 is a sectional side view of another modified form of part of the carding machine shown in Fig. 1;
- 10 Fig. 10 illustrates the use of optical fibres (fibre-optic cables) for a camera and an illuminating device; and
- Fig. 11 is a view similar to Fig. 3 but also showing in block diagram form a control arrangement
- 15 for the machine.

Fig. 1 shows a carding machine, for example, of the type sold by Trützschler GmbH & Co. KG as the EXACTACARD DK 760, with a feed roller 1, feed table 2, lick-in 3, cylinder 4, doffer 5, stripper roller 6, nip rollers (squeezing rollers) 7, 8, web-guide element 9, sliver funnel 10, delivery rollers 11, 12 and a revolving card top 13. Beneath the evener roller 6 there is arranged a supporting and guiding member 14, and the upper nip

20 roller 7 is arranged closely adjacent to the stripper roller 6. The direction of rotation of the cylinder 4 and each roller is indicated by a curved arrow. The



reference numeral 15 denotes the region in which the detached card web 16 (see Fig. 2) passes from the stripper roller 6 to the nip rollers 7, 8.

Fig. 2 shows that the supporting and guiding member 14 essentially has a four-cornered cross-section. The upper surface 14a is slightly concavely curved. The radius of curvature of the surface 14a is greater than the radius of curvature of the stripper roller 6. The arrow A indicates the running direction of the fibre web 16. One top end region 14b of the member 14 has an edge, the other top end region 14c is rounded (14b and 14c are marked in Fig. 3). The edge prevents deposition of contaminants, for example, honey dew. A sliding contact region 14d (see Fig. 3) of the surface 14a has, for example, waste cleaned from it by the web 16 sliding over it. The cross-sectional shape of the member 14 is chosen having regard to the air flow in the region between the doffer 5, the stripper roller 6 and the nip rollers 7, 8. The member 14 serves as a supporting and guiding member for the fibre web 16. The end region 14b is in the form of a supporting surface for the fibre web 16. The surface 14a also serves in the end region 14b as a guide surface for the web 16. Each of the end regions 14b and 14c is located on a different side of the vertical diameter of the stripper roller 6, viewed in the fibre running direction A. The member 14 is in the form of a housing, a transparent window 17 being provided in the sliding contact region 14d. The fibre web is located

initially on the clothing of the doffer 5, is guided in the roller nip between the doffer 5 and the stripper roller 6 around and over the clothing 6a of the stripper roller 6, is detached from the stripper roller 6

5 approximately just after the region of the vertical diameter of the roller 6, is guided by the sliding contact region 14d on the surface 14a in direction A, over the end region 14b, then runs completely freely and finally enters the roller nip between the nip rollers 7, 8 and passes through these. The upper surface 14a of the member 14 faces towards the clothing 6a of the stripper roller 6. The end region 14c of the member 14 is associated with the roller nip between the doffer 5 and the stripper roller 6. The other end region 14b is

10 arranged in the region between the stripper roller 6 and the nip rollers 7, 8, the edge being oriented in the direction of the roller nip between the nip rollers 7, 8. The member 14 is an extruded section, for example of aluminium, having an interior cavity 14e.

20 As shown in Fig. 3, in the interior 14e of the housing 14, a camera 18, for example, a diode line camera, an illuminating device 19 (see Fig. 4), for example, comprising several luminous diodes, and an angled mirror 20 are arranged on a carriage 21. The

25 angled mirror 20 is arranged at an angle between the lens 18a of the camera 18 and the illuminating device 19 on the one hand, and the inside of a window 17 on the other hand. The card web 16 runs on the outside of the window

17. Wheels 22, 23, 24 of the carriage 21 run in guides 14f, 14g in the inner wall of the housing 14 in directions B, C (see arrows in Fig. 4) across the width of the machine.

5       As shown in Fig. 4, two rotatable cable rollers 25, 26 are provided, around which a cable 27 runs; each cable is attached by one end to a respective end face 21a, 21b of the carriage 21. The pulley 25 is driven by a motor 28, so that the carriage 21 can be moved to and fro in  
10 the direction of arrows B and C. The upper portion of the cable 27 is located in the region between the camera 18 and the top wall 14i of the member 14. The camera 18, the illuminating device 19a, 19b (which can consist, for example, of a plurality of luminous diodes, flash lamps  
15 or similar means) and the angled mirror 20 are secured to the carriage. Connected to the end face 21a of the carriage 21 is one end of a flexible flat conductor cable 29 which is designed in the manner of a wind-up and unwind chain conveyor, and the other end of which is  
20 connected to an electronic control and regulating device 30. The flat conductor cable 29 contains the connection leads from the control and regulating device 30 and a power supply device (not illustrated) to the camera 18 and the illuminating device 19. The flat conductor  
25 cable 29 has two 180° bends and the lower portion of the flat conductor cable 29 is located in the region between the base wall 14h of the housing 14 and the carriage 21.

As shown in Fig. 5, the carriage 21 has three wheels

22, 23 and 24 each of which is rotatable about its axis. The wheels 23 and 24 run in the recess 14f and the wheel 22 runs in the recess 14g in the interior 14e.

As shown in Fig. 6, one end of the housing 14 is mounted by being slid into an end piece 36, which is secured to one wall 37a of the frame of the carding machine. The hollow interior of the end piece and the outer surface of the housing 14 are matched to one another to provide an interlocking fit. The end region rests with its end face against the inner surface of the wall 37a. The other end of the housing 14 is mounted by being slid through another end piece 38 (profiled guide member) which is secured to the other wall 37b of the carding machine. The hollow interiors of the end piece 36 and the profiled guide member 38 and the outer surface of the housing 14 are matched to one another to provide an interlocking fit, so that the housing 14 is fixedly mounted in operation. It is secured against displacement by screws (not shown). The end of the housing 14 projects from wall 37b by a distance c, forming a hand grip for when the housing is to be exchanged. The housing 14, which is shown in Fig. 6 without its middle section, is of one-piece construction. In the interior 14e there are two rotatable pulleys 25, 26 at the lateral extremities of the housing; the cable 27 that acts on the carriage 21 and is movable in the directions of arrows C, D runs around the pulleys 25, 26. The camera 18 and the illuminating device 19 are secured on the

carriage 21 and are directed towards the window 17. The camera 18 is connected by way of a lead 31 and the illuminating device 19 is connected by way of a lead 32 to the control and regulating device 30. In Fig. 6 the letter b denotes the width of the stripper roller 6 and the letter a denotes the region of the stripper roller 6 provided with clothing 6a.

As shown in Fig. 7, an electronic control and regulating device 30 is provided, to which, inter alia, the camera 18, the illuminating device 19, an image evaluating device 50, the drive means, for example, the electric motor 28 for the carriage 21, and a device 33 for measuring the speed of the evener roller 6 are connected.

Figs 8 and 9 show the nip rollers 7, 8, following which is the sliver-forming device 9, for example, a device sold by Trützschler GmbH & Co. KG as the Trützschler Web-speed device, with sliver funnel 10 and delivery rollers 11, 12. The card web 16 leaves the nip rollers 7, 8 across the width of the machine, enters an opening in the sliver-forming device 9 and is condensed in the sliver funnel 10 to form a fibre sliver. As shown in Fig. 8, a camera 18' is arranged below the card web 16 (see Fig. 2) and as shown in Fig. 9 a camera 18'' is arranged above the card web (see Fig. 2).

In the embodiment shown in Fig. 10, the camera 18 and the illuminating device 19 are fixedly arranged. One end of a respective optical wave guide 34, 35 (for

example, of glass fibres) is connected to the image entry element (lens) of the camera 18 and to the light output element of the illuminating device 19. The other end of each of the optical waveguides 34 and 35 is associated  
5 with the glass window 17 and is there movable across the width a of the evener roller 6 or the machine.

Apparatus embodying the invention allows a nep-counting operation to take place on-line, in place of sample-taking in a laboratory. The apparatus, for  
10 example, that sold by Trützschler GmbH & Co. KG as the NEPCONTROL NCT, is an on-line measuring system for detecting waste, seed husk particles and neps. In the region below the stripper roller 6 in which the web becomes detached, a video camera 18 traverses across the  
15 operating width of the carding machine in a shaped web guide member 14. The camera 18 delivers sharp images of the web 16, even at a production speed of 300 m/min, and transmits them, as shown in Fig. 11, to a computer 30 of the NEPCONTROL NCT. This evaluates the images according  
20 to number, type and size of the unwanted particles. It is able to differentiate between waste and seed husk particles and neps. The results are indicated by way of the machine control 50, for example, that sold by Trützschler GmbH & Co. KG as the Card-Commander, on a  
25 display 40, or are passed to another unit, for example, that sold by Trützschler GmbH & Co. KG as the Trützschler Sliver Information System KIT (not illustrated) for further processing.

The apparatus according to the invention is simple to install in or remove from a carding machine. In this manner a periodic measurement on alternate carding machines is possible.

5       The measuring operation is carried out as the card web is being conveyed. Through the viewing window 17 the card web is recorded by the camera 18. Light from the device 19, which may include a flash light and/or a steady light, is incident on the web and reflected back  
10 by it (see Fig. 11). Evaluation is effected on the principle of the comparison of desired and actual values. The intensity of the light reflected by the web in relation to the intensity of the light beamed onto the web is used as a measurement parameter. The  
15 characteristic of cotton is automatically detected by the system and used as reference. Material having a different characteristic is recognised when the extent is, for example 5 mm in the smallest axis.

A light module may be provided which is for beaming  
20 light onto the web and which comprises a semiconductor flash lamp of high homogeneity, a command-controlled high-speed measuring camera 18 (with digital data output (e.g. according to DE-A- 43 13 621) and an angled mirror  
20 which enables there to be a reduction in the overall  
25 height. A further light module, which is a transmitted-light module and which comprises a large-area high-intensity semi-conductor flash lamp may also be provided on the opposite side of the web so that the camera 18

detects light passing through the web from the transmitted light module.

In operation, transmitted light and reflected light can be used to detect the neps/foreign fibres and foreign particles. Two images can be taken in very quick succession, one in transmitted light and one in reflected light. Both images can be combined and evaluated jointly. The light can be switched on in flashes and controlled by the camera 18 or its control system. Light of different wavelengths can be used for the individual shots. In that case, more than one illuminating device can be used for one shot. For example, the reflected light module can have more than one illuminating device. Illumination can be effected from different directions. Illumination can also be effected from different sides (transmitted light and reflected light). Light sources having different wavelengths can be used for illumination. The different directions, sides and wavelengths can also be combined with one another. Different illumination times (flash times) can be set.

According to the embodiment of Fig. 11, the camera 18 and the illuminating devices are connected by way of the computer 30 to the image-processing device 50, to which a monitor 40, a control element 41, for example, a machine control device, and a device 42 (adjusting means) for influencing the number of neps, waste bits and/or seed particles in the card web are connected. The device 42 can initiate steps to change the number of neps in the



card web, for example, by changing the spacing between the card top clothings and the cylinder clothing of the carding machine, the speed of the cylinder, the spacing of a waste separating blade from a roller, a guide  
5 element and so on.

Apparatus embodying the invention allows an automatic detection and reduction in the number of neps in the card web. An important factor is detection at the card web, when it is detached from the stripper  
10 roller and is therefore free. The invention is explained by the example of a particular type of carding machine. It includes also other machines in which a fibrous web is produced, for example a different type of carding machine.

15 It should be appreciated that features described with reference to one of the illustrated embodiments may also be incorporated in another of the illustrated embodiments, where appropriate. For example, the camera shown in Fig. 8 may be mounted in a housing as described  
20 with reference to Figs. 3 to 6.

Claims:

1. A carding machine including a camera for detecting unwanted matter in fibre material passing through the machine, wherein the camera is arranged to monitor a  
5 card web as it is transferred between one fibre transport or processing means and the next fibre transport or processing means.
2. A carding machine according to claim 1, in which said one fibre transport or processing means is a  
10 stripper roller to which fibre passes from a doffer and the next fibre transport or processing means is a pair of nip rollers.
3. A carding machine according to claim 2, in which the camera is arranged on the side of the card web remote  
15 from the stripper roller.
4. A carding machine according to claim 2 or 3, in which the camera is arranged beneath the stripper roller.
5. A carding machine according to claim 1, in which said one fibre transport or processing means is a pair of  
20 nip rollers and the next fibre transport or processing means is a sliver forming device.
6. A carding machine according to claim 5, in which the camera is arranged above the card web.
7. A carding machine according to claim 5, in which the  
25 camera is arranged below the card web.
8. A carding machine according to any preceding claim, in which a fixed support member for the card web is

provided between said one fibre transport or processing means and the next fibre transport or processing means.

9. A carding machine according to any preceding claim, further including an illuminating device for illuminating  
5 the region of the card web viewed by the camera.

10. A carding machine according to any preceding claim, in which the camera is a diode line camera.

11. A carding machine according to any preceding claim, in which the camera includes at least one CCD component.

10 12. A carding machine according to any preceding claim, further including an evaluating circuit for evaluating an electrical output signal from the camera.

13. A carding machine according to any preceding claim, in which the camera is mounted in the interior of a  
15 housing.

14. A carding machine according to claim 13, when dependent upon claim 8, in which the fixed support member comprises at least a part of the housing.

15. A carding machine according to claim 13 or 14, in  
20 which a wall of the housing has a window through which the camera views the card web.

16. A carding machine according to claim 15, in which the window is made of a transparent material.

17. A carding machine according to any one of claims 13  
25 to 16, in which the housing is formed at least partly from an extruded section.

18. A carding machine according to any one of claims 13 to 17, in which the housing is substantially closed.

19. A carding machine according to any one of claims 13 to 18, in which the housing extends across substantially the entire working width of the machine.

20. A carding machine according to any one of claims 13 to 19, further including one or more guides extending across the housing, and a carriage mounted for movement across the housing, the carriage being mounted on the carriage.

21. A carding machine according to claim 20, further including a drive arrangement for driving the carriage across the housing.

22. A carding machine according to claim 21, in which the drive arrangement includes pulleys at opposite sides of the housing and an elongate drive member, for example a cable, which is connected at opposite ends to the carriage and passes around the pulleys.

23. A carding machine according to claim 22, further including a drive device, for example a motor, for rotating at least one of the pulleys.

24. A carding machine according to any one of claims 20 to 23, further including an electronic control device for controlling movement of the carriage.

25. A carding machine according to claim 24 when dependent upon claim 23, in which the drive device is connected to the electronic control device.

26. A carding machine according to claim 24 or 25, further including sensing means for detecting the limits of movement of the carriage, the sensing means being

connected to the electronic control device.

27. A carding machine according to any one of claims 20 to 26, when dependent upon claim 9, in which the illuminating device is mounted on the carriage.

5 28. A carding machine according to any one of claims 20 to 27, in which electrical connections are made to the camera and/or the illuminating device via at least one flexible cable.

29. A carding machine according to claim 28, in which  
10 the cable includes one lead for the camera and another lead for the illuminating device.

30. A carding machine according to claim 28 or 29, in which the flexible cable comprises a resilient helical cable.

15 31. A carding machine according to claim 28 or 29, in which the flexible cable comprises a flat conductor cable.

32. A carding machine according to any one of claims 28 to 31, in which the cable is passed through one or more  
20 openings in a wall of the housing.

33. A carding machine according to claim 32, in which said one or more openings are closed by dust seals.

34. A carding machine according to any one of claims 28 to 32, in which the cable has a plug-in connection in a  
25 wall of the housing.

35. A carding machine according to any one of claims 13 to 34, in which the housing is arranged such that it can be inserted into and removed from the machine.

36. A carding machine according to claim 35, in which the housing is arranged to be inserted into and removed from the machine from the side of the machine through an opening in the machine frame.
- 5 37. A carding machine according to any one of claims 13 to 36, further including means for introducing clean compressed air into the housing.
38. A carding machine according to any one of claims 13 to 37, in which a wall of the housing has one or more  
10 openings for the passage of air.
39. A carding machine according to any preceding claim, further including an angled mirror associated with viewing of the card web.
40. A carding machine according to claim 39, in which  
15 the camera is arranged to view the card web via the mirror.
41. A carding machine according to claim 39 or 40, when dependent upon claim 9, in which the illuminating device is arranged to illuminate the card web via the mirror.
- 20 42. A carding machine according to any one of claims 39 to 41, when dependent upon claim 20, in which the mirror is mounted on the carriage.
43. A carding machine according to any preceding claim, in which the camera comprises one or more optical wave  
25 guides connected to an image sensing device.
44. A carding machine according to claim 9, or any of claims 10 to 43 when dependent upon claim 9, in which the illuminating device comprises one or more optical wave

guides connected to a source of illumination.

45. A carding machine according to claim 43 or 44, in which the one or more optical wave guides comprise one or more fibre optic cables.

5 46. A carding machine according to any one of claims 43 to 45, in which the image sensing device and/or the source of illumination are fixed in position.

47. A carding machine according to any preceding claim, in which the camera is arranged to detect light reflected  
10 by the web.

48. A carding machine according to any preceding claim, in which the camera is arranged to detect light transmitted through the web.

49. A carding machine according to claim 9, or any one  
15 of claims 10 to 48 when dependent upon claim 9, in which the illumination device includes at least one flashlight source.

50. A carding machine according to any preceding claim, in which the processing means is capable of detecting the  
20 number of neps in the card web.

51. A carding machine according to any preceding claim, further including processing means for processing signals from the camera and an adjusting element operative to adjust the operation of the machine, the adjusting  
25 element being arranged to be controlled by an output signal from the processing means.

52. A carding machine according to claim 50 and 51, in which the adjusting element is operative to adjust the

operation of the machine in such a way as to adjust the number of neps in the card web.

53. A carding machine according to claim 51 or 52 in which the adjusting element is operative to adjust the  
5 distance between clothing of card flat bars and clothing of the carding cylinder.

54. A carding machine according to claim 53, in which the machine has a revolving card top and the card flat bars are bars of the revolving card top.

10 55. A carding machine according to any one of claims 51 to 54 in which the adjusting element is operative to adjust the speed of rotation of the carding cylinder.

56. A carding machine substantially as herein described with reference to the accompanying drawings.

15 57. A camera apparatus for a carding machine, the machine being as claimed in any one of claims 1 to 56.

58. An apparatus on a carding machine for detecting unwanted particles, in particular waste bits, neps, seed husks, burls and the like in textile fibre material, for  
20 example, cotton, synthetic fibres and similar materials, in which a measuring section is provided between the stripper roller and nip rollers for the fibre material, wherein a camera, for example, a diode cell camera, is arranged at the measuring section to record the degree of  
25 contamination, and the apparatus includes an illuminating device and an electronic evaluator (image-processing unit), characterised in that the camera is associated with the card web in transition between the stripper



roller and nip rollers.

59. An apparatus on a carding machine for detecting unwanted particles, in particular waste bits, neps, seed husks, burls and the like in the textile fibre material, for example, cotton, synthetic fibres and similar materials, in which a measuring section is provided between the stripper roller and nip rollers for the fibre material, wherein a camera, for example, a diode cell camera, is arranged at the measuring section to record the degree of contamination, and the apparatus includes an illuminating device and an electronic evaluator (image-processing unit), characterised in that the camera is arranged between the nip rollers and the sliver-forming device.
60. A method of viewing a card web travelling through a carding machine, the machine being as claimed in any one of claims 1 to 56.



# The Patent Office

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Application No: GB 9607621.1  
Claims searched: 1-56, 58-60.

Examiner: Graham Werrett  
Date of search: 18 June 1996

## Patents Act 1977 Search Report under Section 17<sup>a</sup>

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): D1D, D1F, D1N, G1A.

Int Cl (Ed.6): D01G, D06H, G01N.

Other: Online: WPI.

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2225634 A (TRUTZSCHLER)	1, 58, 59.
X	GB 2210907 A (HERGETH)	"
X	EP 0604875 A (ZELLWEGER)	"
X	WO 95/22762 A (MOR)	"
X	US 5130559 A (TRUTZSCHLER)	"
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